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ABSTRACT

The interaction between computer/information technology and the teaching professoriate is considered. Based on a model introduced in 1984, the first encounter with computing is viewed as an alien culture into which the novice must be socialized. Three distinct stages occur in socialization: reality shock, confusion, and attempts at control. To ease the transition of the teaching faculty into the computing culture, the college needs to develop programs to help faculty progress through each of these stages. Novices need to be forewarned about the nature of computing work and about its strengths and weaknesses. The effectiveness of different programs of anticipatory socialization on the reduction of reality shock need to be examined. Among the considerations for schools are: providing hands-on experience through inservice workshops and conferences determining how often workshops should be offered, and deciding on the usefulness of general discussions of computer capabilities and applications. At the stage of exerting control or mastery, two major issues should be studied: sources of faculty resistance to computerization and mechanisms to overcome resistance. Psychological reactance, fear of technology, and role conflict and role reversal are sources of faculty resistance to computerization. (SW)

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COMPUTER LITERACY AND THE FORGOTTEN PROFESSOR

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COMPUTER LITERACY AND THE FORGOTTEN PROFESSOR

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We are living today in an age of "high technology" in which computers, especially personal computers, command center stage. This observation is neither revolutionary nor even revelatory; it merely states the obvious. Of course, there is evidence available to support the obvious. The opening article in the new journal Computers in Human Behavior presents a summary of some of this data (Elwork & Gutkin, 1985). Examples include the following. In January, 1983, Time magazine selected the computer as its 1982 "Man of the Year," marking the first time in this 56 year Time tradition that a nonperson was selected for the honor (Meyers, 1983). In 1984, more than 11 million personal computers were sold in the United States, half of them destined for use in the home (U. S. Dept. of Commerce, 1985). In 1985, amid a general slump in computer sales, sales of computers to colleges and universities were on the rise (Turner, 1985). What will specifically happen in 1986 remains to be seen, but it does appear as though computers have "come of age" and are here--in our homes, our workplaces, our schools and colleges, and our consciousnesses--to stay.

This arrival of the computer age was not a sudden and unheralded event. On the contrary, it has a developmental history (Caporael, 1984) during which society has long been discussing, debating, and anticipating this very era. Norbert Wiener (1954), the founder of the science of cybernetics, wrote that:

> . . . society can only be understood through a study of the messages and the communication facilities which belong to it; and that in the future development of these messages and communication facilities, messages between man and machines, between machines and man and between machine and machine, are destined to play an ever-increasing part. (p. 25)

In his collection of essays, Wiener addressed the role that machines, including the then newly developed computer, might play in human relationships and societies. Other philosophers, scientists, and scholars have continued Wiener's discussions and have debated and are still debating such questions as how technology will shape our lives and our institutions (Gehlen, 1980; Mesthene, 1968), how society must respond to technologically induced social changes (Ballard, 1981; Michael, 1966), how autonomous of human control technological growth and change is or can be (Ellul, 1980, 1964; Winner, 1977), what computers can or cannot do (Quay & Dreyfus, 1985; Weizenbaum, 1984), etc.

While almost every area of society has been more or less influenced by the computer age, the area on which we will focus our attention is education, particularly higher education. Issues of information technology and computer literacy have begun to command a great deal of theoretical and research attention in the academic community. Evidence for this assertion is easily obtained. Look, for example, at this or last year's AERA annual meeting program and the number of presentations in it that are related to computers and education. Look, for another example, at professional newsletters or magazines such as the Educational Researcher and the Chronicle of Higher Education which have initiated columns on computer/education issues. Look at professional journals such as

the Journal of Social Issues and the School Psychology Review which have devoted special issues to computer-related topics (Caporael & Thorngate, 1984; McCullough & Wenck, 1984). Look, finally, at the growing number of new journals focusing on and devoted to computer issues (e.g., Computers in Human Behavior, Computers and the Social Sciences, and The Journal of Educational Computing Research).

The question is obviously not one of will educational institutions, goals, processes, and participants be influenced by computers but, rather, one of how will educational institutions, goals, processes, and participants be influenced (Chorover, 1984). In we can agree with Shavelson and Salomon (1985) that the "pedagogical promise of the new technology is boundless if we can master the technology," then it is clear that we must proceed to discover the best means through which to master the technology and enable it to meet its "pedagogical promise." This is no easy task. Mastering computer technology to enable it to meet its pedagogical promise presupposes that we already have a clear philosophical and pedagogical vision of where we want to go and how we are to get there. Such is not the case, and one has only to examine a sample of the burgeoning literature on computers in education to recognize that great diversity and, to some extent, confusion reigns.

At the theoretical level, controversy and debate over the role computers can or should play in education proceeds on several interrelated fronts. According to Seymour Papert (1984) of the Massachusetts Institute of Technology (MIT), computers can and should be introduced into the classroom as early as possible. On

the other hand, Joseph Weizenbaum (1984), also of MIT, regards "the belief that it is very urgent that we put computers in primary and secondary schools" as a "mass delusion" and "quick technological fix" (p. 225). Hubert and Stuart Dreyfus (1984) of the University of California, Berkeley recognize and accept a "rapidly increasing role" for computers in education but question what that proper role should be. Such diversity of opinion is a reflection of fundamentally different views of learning and the learner on the one hand and the need for and importance of computer literacy on the other hand. If views on these latter two issues would converge, one result might be a more convergent, coherent position on the role of computers in education. This observation notwithstanding, the history of research and theory on learning and learners suggests that convergence on any one theory is unlikely. It may be, as Jerome Bruner (1985) concluded in his 1985 AERA Invited Address, that there is not one kind of learning or learner, but several, and that "the best choice is not a choice of one, but an appreciation of the variety that is possible" (p. 8).

While views of learning and learners may be necessarily varied, views on the meaning of computer literacy are converging on a dominant position. In developing their Standardized Test of Computer Literacy at Iowa State University, Montag, Simonson, and Maurer (1984) defined computer literacy as,

> an understanding of computer characteristics, capabilities, and applications, and the ability to implement this knowledge in the skillful, productive use of computer applications suitable to individual roles in society. (p. 7)

The Iowa test consists of four sections: computer systems, computer

applications, computer programming, and computer attitudes. The Educational Testing Service (ETS) is also developing a national test of "computer competence" to be administered for the first time in Spring, 1986 to 3rd, 7th and 11th graders. Three areas of competence will be assessed: computer applications, programming and knowledge of and attitudes towards computers (Benderson, 1985). At the same time that ETS embarks on its ambitious plans for the national assessment of computer literacy, though, Joseph Weizenbaum and others are questioning the need or value of such computer literacy. According to Weizenbaum (1984), computers will become increasingly "invisible" as they pervade the society. "The student and the practicing professional will operate special-purpose instruments that happen to have computers as components" (p. 225), but they will not need to understand the functioning or programming of that computer--much in the same way that we do not need to understand an electric motor when we use an automobile, can opener, vacuum cleaner, dishwasher, etc.

The theoretical diversity and disagreement over the role of computers in education is paralleled by similarly diverse attempts to introduce and study computers in the classroom. In most of these classroom applications, attention has focused on computers in one of three roles: as tutors for drill and practice routines, as tools for managing data, processing words, or performing simulations, or as objects of programming (Taylor, 1980). The literature in this area has taken so many different forms, generated so much data, and, in general, become so vast that it has given rise to a new generation of studies whose purpose is to

summarize, analyze, and integrate the existing research data (see, for example, Kulik, Kulik, & Bangert-Drowns, 1985; Kulik, Bangert, & Williams, 1983; Kulik, Kulik, & Cohen, 1980). At the same time that researchers are investigating the effectiveness of computer applications in the classroom, there are other researchers who are examining the impact of computers on the social interactions and environment of the classroom (Sheingold, Hawkins, & Chen, 1984) and the university (Sproull, Kiesler, & Zubrow, 1984). Yet, in the midst of all this research attention, there still remains one population of subjects that has been largely overlooked or ignored by researchers. This population is the teaching professoriate, which includes those large numbers of professors in postsecondary institutions who are engaged primarily in the task of teaching and who can be distinguished from the research professoriate whose primary task is research and publication.

The teaching professoriate is in a position to educate and influence generations of future students. The extent to which these professors accept computers, master computers, encourage computer mastery in their students, use computers in their classes, etc. will have a marked influence on the institution's and educational system's transition into a technological future. In addition to the debates on the role of computers in education, then, we need to discuss and investigate the role of the teaching professoriate in hastening, obstructing, or directing the role that computers will play in education. Sheingold, et al. (1984), for example, have found that:

> . . . teachers' interpretations of the meaning of the software--its purpose and value, and whether it has a

> legitimate relationship to traditional curricular areas and modes of learning--will play a central role in how and whether computers become and integral part of the classroom. (p. 49)

By raising this issue, we are not necessarily advocating a series of new and separate studies with the teaching professor as subject, but we are advocating the importance of recognizing and including the teaching professor in research and theory on computers in higher education.

Such questions are beginning to surface in the computer/education literature. Brier and Robinson (1974) have suggested that the computer will have "unpredictable yet major" influence on social and intellectual life. Stephan Chorover (1984), a neuropsychologist at MIT, who identifies himself as a student of "psychotechnology" interested in the impact of sociotechnological change on the thought and behavior of individuals and the organization and development of human groups, believes that computers in education "will undoubtedly have many more or less profound effects upon how students and teachers relate to one another" (p. 223). His subsequent question, then, is how computers in education will affect these relationships, personally and professionally. Other researchers are being more specific in looking at the university environment and how it will be influenced by computerization. Of specific interest are those colleges and universities in the forefront of computerization--institutions such as Drexel University, Carnegie-Mellon University, Brown University, and Stevens Institute of Technology, all of which are in the process of developing computer-intensive environments. ETS and EDUCOM, for example, are conducting a joint study of six computer-

intensive institutions (Brown University, Carnegie-Mellon Univer ity, Dartmouth College, the University of Houston, Reed College, and Stevens Institute of Technology) with the twofold goals of, first, describing the programs and process of transition and, second, examining the impact of computer-intensive programs on such things as "dorm life and social interaction" (Benderson, 1985). While it is still unclear the extent to which ETS and EDUCOM will examine professors at these computer-intensive institutions, there are individual researchers such as Mark Shields, a sociologist at Brown University, who view the question of the impact of computers on social interactions in the campus community, including student-teacher relationships, as "the essential issue" (Waldrop, 1985).

Thus, it appears that questions about the interaction of computer/information technology and the professoriate do have a place in contemporary computer/education research. The questions, as they have been thus far raised, however, are only marginally related to the teaching professoriate. They are related in that the teaching professor is probably included as a member, albeit a nonspecified member, of the college or university environment under study. They are marginal because the computer-intensive institutions being so carefully studied are primarily research oriented institutions and/or institutions with a strong science and technology orientation. What we learn in these institutions will be most useful and relevant to other similar institutions and less relevant to teaching institutions and teaching professors. The institutional and social dynamics of a teaching institutions with

its emphasis on teaching rather than research and publication can be markedly different from a research institution. Yet these teaching institutions are also entering into the computer age. The fundamental motivation to computerize a campus may be the same in teaching and research institutions--that is, to stay abreast with new educational developments and prepare one's students accordingly--but the need to computerize in areas other than science and technology and the desire and commitment to do so may vary significantly. We ought not to ignore these potential differences and neglect to study the issues and problems unique to teaching institutions. It is only by understanding the total picture that we in higher education can take a proactive rather than a reactive role in the computerization of education.

This is no small task, and the present paper does not propose to attempt an analysis of every aspect of such a complex issue. The focus is, rather, on one aspect of the problem--that is, the mutual interaction between computer/information technology and the teaching professoriate. Underlying this focus is the assumption that the teaching professoriate will be influenced by increased computerization of their institutional environments while simultaneously influencing the course and direction that this campus computerization will take. The present paper offers a model from which we can conceptualize the problem and identifies specific critical issues that need to be empirically investigated.

The model I propose was first introduced by Sproull, Kiesler, and Zubrow (1984) in their study of undergraduate students' responses to a computer-intensive university environment. In their

study, Sproull, et al. suggest that computing on college campuses is, to the novice who is encountering it for the first time, an alien culture into which they must be socialized. This process of socialization proceeds in three distinct stages: reality shock, confusion, and attempts at control. The success or failure of the socialization process depends largely on the success or failure of the individual's attempts at control in the alien culture. Successful attempts at control are associated with mastery of the computing culture and result in "cultural recruits" who have accepted and adapted to the alien culture. Unsuccessful attempts at control are associated with anger or withdrawal and result in "cultural dropouts" who have rejected the alien culture. Empirical data collected by Sproull, et al. on undergraduate students' encounters with the computing culture lend support to their model of computing as an alien culture into which novices must be socialized. As more and more colleges computerize their campuses, increasing numbers of the teaching professoriate will be confronted by this alien culture and need to be socialized into it. How do we insure a smooth transition? More specifically, how do we maximize the number of cultural recruits and minimize the number of cultural dropouts? The speed and extent to which college campuses will be truly computerized, where computers will constitute an integral part of the educational environment, will depend in large part on this ratio of cultural recruits to cultural dropouts. These questions are, I should add, essential ones regardless of the diverse views that exist on the role of computers in education. Even those who are most wary of a computer ideology that promises

revolutionary educational consequences in yet untold arenas accept the notion that computers will play a role in and influence education (Noble, 1984; Zajonc, 1984; Weizenbaum, 1984; Dreyfus & Dreyfus, 1984). We need, then, to understand the means by which to insure a smooth transition.

What can we do to ease the transition of the teaching professoriate into the computing culture? The Sproull, et al. model leads us to focus our attention on the three stages of socialization and to identify ways to maximize successful progression through these stages. Undergraduate subjects in the Sproull, et al. study exhibited high reality shock and confusion and were often unsuccessful in their attempts to reestablish control through mastery. One means of easing the teaching professoriate's transition into the computing culture would be to minimize the reality shock and confusion that accompanies novice encounters with the computer. Among the undergraduates, high reality shock seemed to be caused by the contrasts between computer work and other academic work and between expectations and reality. According to Sproull, et al., "anticipatory socialization" is one means of reducing this reality shock. Novices need to be adequately forewarned about the nature of computing work and about its promises and limitations. We need to study the concept of anticipatory socialization and its relationship to successful or unsuccessful socialization. We need also to examine the effectiveness of different programs of anticipatory socialization on the reduction of reality shock. For example, is it sufficient for institutions to sponsor in-service workshops or conferences for

faculty to get hands-on experience with campus computers? How frequently should these workshops be offered; how intensive should they be? Do faculty benefit most from general discussions of computer capabilities and applications, or do they need to exposed to applications specific to their own disciplines? Is there value in institutionally-sponsored discussions or forums to clarify and identify the purpose and goals of campus computers? Should anticipatory socialization programs be voluntary on the part of faculty or should they be mandated by policy makers? What are the costs and benefits of implementing a program of anticipatory socialization? These are but a few of the questions for which we must seek answers.

Reality shock leads to confusion about one's own capabilities and motivations and raises questions about the capabilities and motivations of other members of the institution. Questions such as can I master this technology, can I find meaningful uses for it, why do I need it, etc. begin to surface and demand a response. The level of confusion experienced by the novice seems to be related to the level of reality shock--the greater the reality shock, the greater the confusion. And, confusion, if it is severe enough, can serve as an obstacle to any attempts to exert control and master the new technology. Chorover's (1984) observation that "computer-based systems should not be introduced from the top down" (p. 226) is relevant here. Too often, remarks Chorover, policy makers choose the hardware and software, and faculty must learn to live with these choices and to define their goals and functions in terms of the existing system. Such top down decision-making exacerbates

reality shock among novices and contributes to confusion over their role and place in the computerized campus. Alternative modes of decision-making need to be explored in terms of their impact on computer socialization, and programs of anticipatory socialization should reflect the results of this research. Institutions need to seriously address the question of what role the computer is to play on their campus. If policy makers have shortsighted goals or exaggerated expectations, if their vision of the computerized future is unclear or confused, then faculty responses to campus computerization will also be unclear and confused, and the computerization of campuses is likely to be "considerably less than a revolution" (Noble, 1984).

Reality shock and confusion are distinct stages in the process of being socialized into an alien culture and they deserve to be investigated in their own right in order to determine their effects on successful or unsuccessful socialization. The critical stage of socialization, however, the one that ultimately determines if the individual will be a cultural recruit or a cultural dropout, seems to be stage three where the individual attempts to exert control or mastery in the alien culture. There are two major issues at this stage that need to be investigated. First, we need to examine the sources of faculty resistance to computerization and to discover mechanisms to overcome it. Second, we need to examine the role of administration in advancing campus computerization goals.

Research on other subject populations suggests that there are psychological and practical sources for faculty resistance to computer/information technology. Top down decision-making and

mandates can certainly lead to psychological reactance among many faculty members who may perceive the policies as threats to their freedom and expertise or as breaches in the spirit of campus collegiality and governance. The rhetoric of the computer ideology, either on campus, in one's professional literature, or simply in the society at large, is also a potential source of psychological reactance among faculty. Contemporary computer rhetoric allows little room for choice on the part of faculty members. Students are asking for computers, parents are asking for computers, other faculty and administrators are asking for computers, even state and local governments are asking for computers to be used in the schools. Faculty resistance to campus computerization may be more a resistance to such limited courses of action than a rejection of computer/information technology itself.

In addition to psychological reactance, faculty members must contend with technophobia, the fear of technology. Successful socialization into the computing culture requires that faculty members be able to master the machines that are, initially at least, so alien to them. The degree to which teaching professors experience such technophobia and the means by which such fears can be overcome is a fertile source of investigation. Some observers argue that technophobia is a generational problem which will disappear in 25 or 30 years when older people who are untrained in the use of computers will be retired and replaced by computer-wise recruits (Caporael & Thorngate, 1984). While this observation may be true, waiting for faculty technophobes to disappear through retirement may not be a wise course of action since our educational

system, especially our colleges and universities, have charge, after all, of preparing and educating future generations of students and computer-wise recruits. Technophobia does exist, but the extent to which it exists among the teaching professoriate has yet to be determined. Research data reported by Montag, et al. (1984) on group differences on their Computer Anxiety Index shows college students to have the highest anxiety scores of the six subject groups studied, followed by teachers from all grade levels. The researchers furthermore report that "cognitive computer literacy competencies are difficult for extremely computer anxious students to acquire" (p. 5). Since college professors were not studied as a separate group by Montag, et al., the relationship between computer anxiety in teaching professors and computer mastery needs to be further explored.

A third psychological source of faculty resistance to computerization is role conflict and role reversal. During this transition period when faculty are trying to master the computer culture at the same time that they might be trying to introduce their students to this culture, faculty are likely to discover that some of their students are more expert than they. Such a situation is contrary to the traditional classroom situation in which a single adult serves as "an expert resource for a large group of novices" (Sheingold, et al., 1984). Such a reversal of traditional roles may be threatening to many faculty and may result in their resistance to computerization. While Sheingold, et al. are directing their comments primarily at the primary or secondary levels of education, these same dynamics can occur in the college

classroom. We need to investigate the nature of such role reversals in the college classroom and the degree to which they obstruct "progress."

Interacting with the psychological sources of resistance to campus computerization are practical issues of time or lack thereof. Calfee (1985) has pointed out that "teachers do not change quickly," a behavior which he attributes to their already heavy work load. Although primary and secondary school teachers are the targets of Calfee's remarks, there is no reason to exclude overworked teaching professors from his contention that "any additional tasks, any new requirements, any change from the status quo, had better be clearly justifiable and quick to provide payoff" (p. 10). In the novice's encounters with the computing culture, however, what the novice soon discovers is that computer competencies do not come quickly or easily. Caporael (1985) reports that time spent by college students on computers in their rooms was inversely related to time spent on books. Subjects in the Sproull, et al. study (1984) reported that they had to spend much more time on computing tasks than they had anticipated. It is likely that teaching professors in their initial encounters with the computing culture will make similar discoveries and, in so doing, will have to decide from whence the time will come. Demands on faculty time may set the stage for a choice between staying abreast with the research and theoretical literature in one's discipline or spending time trying to master a new technological tool on the promise that it can open up new educational horizons.

The second major issue that needs to be explored at this third stage of socialization is the role that administration should or must play in advancing campus computerization goals. A serious computer revolution in education, particularly one in our colleges and universities, is not likely to occur if computers are spread out so thinly as to be inaccessible or unavailable (Noble, 1984). Access to computers is a major institutional issue which will determine the nature and course of campus computerization. One study on computing and higher education estimated that "the cost of fully equipping a 5000-student university would be approximately $32 million" (Waldrop, 1985, p. 441). Such major expenditures require serious commitment on the part of administrations, but they also require a committed or convinced faculty. The success of such capital outlays for computer technology will depend on faculty "cultural recruits" making use of these computers. In order for faculty to be successfully socialized into the computing culture requires yet more commitment and expense on the part of administrations. According to Roger Kershaw, director of the ETS Technology Research Group (Benderson, 1985),

> . . . if administrators are unwilling to grant teachers sufficient release time to adapt application programs to their courses, computers in education will go the way of such failed innovations as the teaching machine. (p. 9)

Release time may also not be enough; administrators will need to consider the feasibility of funding programs for faculty retraining and development. Drexel University, one of the first institutions to develop a computer-intensive environment obtained a $2.8 million grant to fund a faculty retraining program for its 350 full-time

and 200 part-time faculty. At institutions with fewer financial resources, administrators must develop more modest goals for campus computerization, but they must recognize that even these modest goals can be jeopardized if faculty are not provided with adequate incentive, training, and release time to take advantage of the new technology.

In conclusion, let me summarize my position. Computers in some form or another are here to stay and we as educators must proactively chart the course that these computers will play in our institutions. At the college or university level, we should recognize that for many faculty the computing environment will be an unfamiliar one. This is more likely to occur in teaching institutions where there is less pressure for research and publication and, concomitantly, less exposure to state-of-the-art computer/information technology. If we can accept the premise that teaching professors are in a position to influence future generations of students and are also in a position to influence and be influenced by computer on campus, then we can agree that it may be important to investigate the means by which we can insure a smooth transition of the teaching professoriate into the computer age. This paper has offered a model, derived from research by Sproull, et al. (1984) from which to view this issue. It argues that computing is an alien culture into which the teaching professoriate must be socialized and that successful socialization into this culture will depend on the ability of institutions to develop programs to reduce reality shock and confusion and to facilitate attempts to establish control within the alien culture.

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